

APPENDIX C

BEST MANAGEMENT PRACTICES

SOUTH DEEP MANAGEMENT PROJECT

Best Management Practices (BMP's) are defined as "methods, measures, or practices selected by an agency to meet its nonpoint source control needs. BMP's include, but are not limited to, structural and nonstructural controls, operations, and maintenance procedures. BMP's can be applied before, during, and after pollution-producing activities to reduce or eliminate the introduction of pollutants into receiving waters." (40 CFR 130.2, EPA Water Quality Standards Regulation) The selection and design of BMPs are an integral part of the Colville National Forest's Land and Resource Management Plan Standards and Guidelines for Soil, Water, and Air (Forest Plan, pg. 4-50 to 4-54). The BMP process, including monitoring, is described in the Forest Plan, page 4-51 item 3; and the Forest Plan Appendix G. Appropriate BMPs are selected for each project by an interdisciplinary team. BMP selection and design are dictated by site-specific water quality objectives, soils, topography, geology, vegetation, climate, economics, institutional constraints, etc.

The following were documented for each BMP selected:

- Title of the BMP in *General Water Quality Best Management Practices*.
- Objective of the BMP.
- Explanation of the need for the BMP.
- Implementation and Responsibility: an explanation of how the BMP will be achieved and who will be responsible for implementation of the BMP.
- Ability to Implement: The ratings are:
 - High: Almost certain the BMP can be implemented as planned. These BMPs are usually implemented using the Planning Process, Timber Sale Contract Provisions, road-building specifications, Forest Service manual direction, environmental documents, and Forest Plan Standards and Guidelines.
 - Moderate: Greater than 75% certainty the BMP can be implemented as planned. Implementation of the BMP may be dependent on factors such as funding, unidentified physical constraints (soil or topographic conditions), or extreme weather events (such as a 50- or 100- year flood).
 - Low: Less than 75% certainty the BMP can be implemented as planned. Examples of low ability to implement are conflicting regulatory requirements, excessive project restrictions, or lack of funding.
- Effectiveness: The ratings are:
 - High: Practice is highly effective (> 90%) and one or more of the following types of documentation are available:
 - Literature/Research - must be applicable to the area.
 - Administrative studies - local or within a similar ecosystem.
 - Experience - judgment of an expert based on education and/or experience. During the BMP selection design process, qualified personnel such as the Interdisciplinary Team, Sale Administrators, etc. will review BMPs.
 - Fact - obvious by reasoned (logical) response.
 - Implementation and effectiveness of this practice will be monitored and the practice will be modified if necessary to achieve the objective of the BMP.
 - Moderate: Documentation shows that the practice is effective less than 90% of the time but at least 75% of the time; or professional judgment is that this practice is highly effective, but there is little or no documentation. Implementation and effectiveness of this practice will be monitored and the practice will be modified if necessary to achieve the objective of the BMP.
 - Low: The practice is effective less than 75% of the time; or effectiveness unknown or unverified, there is little or no documentation, and professional judgment is uncertain. This practice is speculative and needs both effectiveness and validation monitoring.
- Monitoring plan for the specific BMP

TIMBER AND VEGETATION MANAGEMENT BMPS

PT-1. Timber Sale and Vegetation Management Planning Process

Objective: To introduce water quality and hydrologic considerations into the timber sale planning process.

Explanation: The timber sale planning process identifies problems and provides for administrative controls, corrective treatments, and preventive measures.

Implementation and responsibility: The South Deep Watershed Analysis was done under contract with David Evans and Associates. The contractor conducted riparian and road condition surveys as part of the watershed analysis. The South Deep EA fisheries analysis was conducted by Tom Shuhda, Forest Fisheries Biologist. The soil analysis was conducted by Nancy Glines, Forest Soil Scientist, and the hydrology analysis was conducted by Joe Coates, West Zone Hydrologist. Their analyses included direct, indirect, and cumulative effects. The analysts recommended practices to protect water quality.

A Forest Service ID Team reviewed these recommendations. The review team consisted of Dave Newton, Timber Sale Administrator; Mary Hendricks, Transportation Planner; Don Gonzales, Forest Planning/Monitoring Staff; Mike Lawrence, Acting District Ranger; and Jim Parker, Forest NEPA Coordinator.

Ability to Implement: High

Effectiveness: High

Monitoring: Planning quality is monitored by Jim Parker, the Forest NEPA Coordinator during his review of the EA and the analysis files.

PT-2. Timber Harvest Unit Design (See INFISH Standards and Guidelines, TM-1)

Objective: To ensure that timber harvest unit design will secure favorable conditions of water flow, water quality and fish habitat.

Explanation: This is an administrative and preventive practice.

Implementation and responsibility: The hydrologic survey and evaluation of proposed timber harvest is accomplished through the interdisciplinary planning process. Streams were excluded from commercial harvest units. Wetlands within harvest units were identified. Streams may occur within the fuels treatment units, and fire prescriptions will be modified to protect soil and aquatic resources. Actual timber sale layout is accomplished by the pre-sale forester, who is responsible for excluding riparian areas. The fuels specialist is responsible for identifying streams on the burn plans and other fuel treatments. The Timber Sale Administrator (TSA) or Contracting Officers Representative (COR) is responsible for monitoring on-the-ground activities.

Ability to Implement: High

Effectiveness: High

Monitoring: Periodic NEPA field reviews will evaluate timber harvest unit design. Also see Forest Plan monitoring guide.

PT-3. Use of Erosion Potential Assessment for Timber Harvest Unit Design

Objective: To prevent downstream water quality degradation by the timely identification of areas with high erosion potential and adjustment of harvest unit design.

Explanation: This is a preventive practice. The potential for erosion and mass wasting are estimated using maps and on-the-ground reviews. Areas with high erosion potential were visited to determine if

special mitigation was required. Areas with high erosion potential generally coincide with steep slopes; these areas will be treated using skyline or helicopter yarding systems.

Implementation and responsibility: The determination of the potential for erosion and mass wasting is part of the pre-sale planning process and is evaluated by a hydrologist or soil scientist.

Ability to Implement: High

Effectiveness: High

Monitoring: Post-harvest reviews will be the primary mechanism to determine if the erosion potential assessment was adequate and whether the proposed treatments were effective.

PT-4. Use of Sale Area Maps for Designating Water Quality Protection Needs

Objective: To delineate the location areas to be protected.

Explanation: This is an administrative and preventive practice. The following features will be designated on the Sale Area Map.

- a. Location of stream courses to be protected. All stream channels within the sale area boundary that have defined bed and banks, whether intermittent or perennial, will be designated for protection and enforced under the terms of the Timber Sale Contract.
- b. Wetlands (including water bodies and seasonally and perennially saturated areas) to be protected
- c. Boundaries of harvest units
- d. Specified roads
- e. Roads where log hauling is prohibited or restricted
- f. Structural improvements
- g. Areas for different skidding, felling, and yarding methods
- h. Sources of rock for road work, riprap, etc.
- i. Water sources available for Purchaser's use
- j. Other features required by Division "C" contract provisions

Implementation and responsibility: The interdisciplinary team identified features on maps which are included in the sale plan or analysis files. The Sale Preparation Forester will also identify, delineate and exclude unmapped wetlands and streams within harvest units to be protected. The Sale Preparation Forester includes these features on the Sale Area Map at the time of contract preparation. The areas are reviewed on-the-ground by the Purchaser and the Sale Administrator prior to harvesting.

Ability to Implement: High

Effectiveness: High

Monitoring: The Sale Area Map is checked by the Sale Preparation Forester, engineers, and watershed specialists to assure accuracy. Accuracy is also checked during post-harvest reviews.

PT-5. Limiting the Operating Period of Timber Sale Activities

Objective: To ensure that the Purchaser conducts operations in a timely manner, within the time period specified in the Timber Sale Contract.

Explanation: The Timber Sale Contract specifies a normal operation season, during which operations may generally proceed without resource damage. Operations will be permitted outside the normal operation season only when they can be conducted without damage to soil, water, or other resources.

The following project-specific modification applies:

The following units have more than 12% existing Detrimental Soil Conditions (compaction and displacement). Winter logging and minimal equipment operation is recommended in these units: DBI, DBK, DBT, DCI, DCT, DFC, DFX, DFZ, ECF, NBW, and SDQ. Units DBT, DCT, and SDQ also have grapple piling as the post harvest fuels treatment; this equipment would negate the benefits of winter logging. Post-harvest grapple piling equipment will therefore be restricted to

existing, designated skid trails in units DBT, DCT, and SDQ.

Implementation & Responsibility: Limited operating periods are identified and recommended during timber sale planning by the interdisciplinary team and incorporated in the Timber Sale Contract. The Sale Administrator ensures that operations occur during the Normal Operating Season, and determines if operations may occur outside the Normal Operating Season.

Ability to Implement: Moderate, since judgment is needed to identify potential damaging conditions.

Effectiveness: High

Monitoring: The TSA and COR will monitor the timing of activities, weather, and ground conditions. Also see Forest Plan monitoring guide.

PT-7. Riparian Habitat Conservation Area (RHCA) Designation

Objective: To designate Riparian Habitat Conservation Area (RHCA) along streams and wetlands where prescriptions will minimize potential adverse effects of nearby logging and related land disturbance activities on water quality and beneficial uses.

Explanation: Riparian Habitat Conservation Areas are defined in the Inland Native Fish Strategy (INFISH) Environmental Assessment of 1995. The RHCA is not always a zone of exclusion, but an area of special management consideration because of high resource values. Factors such as stream class, channel aspect, channel stability, vegetative composition, sideslope steepness, slope stability, surface erosion hazard, and fisheries habitat condition will be considered in determining the constraints of activities and width of RHCA's.

The following project-specific modification applies:

The RHCA width will be the standard required under the Inland Native Fish Strategy: RHCA widths on fish-bearing streams are 300 feet, on perennial, non-fish bearing streams are 150 feet; on intermittent streams and wetlands less than 1 acre are 60 feet; on wetlands greater than 1 acre are 150 feet. A map of the streams and RHCA's is located in the project analysis file. RHCA widths are measured on the slope and extend on both sides of the stream channel (i.e. 600' total RHCA width for fish bearing streams).

No commercial timber harvest will occur within the RHCA's. Fuel storage and refueling will not occur within RHCA's. RHCA's will not be subjected to prescribed fire that would remove the soil protection afforded by the duff layer or adversely impact riparian vegetation. Fireline construction in RHCA's will be avoided whenever possible. Prescribed fires may be allowed to back down into RHCA's if it will not retard attainment of riparian objectives.

Implementation and responsibility: The RHCA requirements are identified by the ID Team during the environmental analysis. The Sale Preparation Forester is responsible for the inclusion of the RHCA's and other areas of avoidance in the Timber Sale Contract and Sale Area Map, as identified in the EA and analysis files. The Sale Administrator is responsible for Timber Sale Contract compliance during harvest operations.

Ability to Implement: High

Effectiveness: High

Monitoring: Post-harvest reviews will evaluate whether the RHCA's were adequate.

PT-8. Stream and Wetland Protection

Objective: To protect stream integrity and avoid management-induced flow obstructions and sediment introduction; to protect the water storage and conveyance functions of wetlands by avoiding soil displacement, rutting, and flow concentrations.

Explanation: In most cases, stream protection will be automatically ensured by exclusion of RHCA's from harvest units. Additionally, the following management controls and practices will be incorporated into the

Timber Sale Contract:

- a. The sale administrator must approve, in advance and on the ground, the location, method, and timing of stream crossings for skid trails, mechanized harvester trails, and temporary roads.
- b. All project debris will be removed from stream channels if it would block or pollute flows. Trees felled over or in protected stream courses or lakeshores (e.g. cable corridors, road right-of-way) that do not block flow will be left unless the Forest Service Representative directs otherwise.
- c. Refueling and fuel storage sites will not be located within RHCA's.
- d. Logs will normally be fully or partially suspended during cable yarding operations within the RHCA of protected streamcourses, and will be fully suspended over the protected streams.
- e. Temporary roads will not be constructed in RHCA's unless no other feasible alternative exists. If temporary road construction in an RHCA is deemed necessary, the sale administrator will consult with road engineering and/or watershed staff to determine appropriate standards for the crossing structure.
- f. Waterbars or other erosion control structures will be located so as to disperse concentrated flow of water and permit the forest floor to trap and retain sediment before it reaches a stream channel.
- g. Precommercial thinning in RHCA's must retain vegetative cover and root masses in quantities sufficient to maintain streambank stability and water temperatures within the natural range of variation.

The following project-specific modifications apply:

Retention of specified trees and special felling and yarding practices may be applied to minimize potential damage to RHCA's. The timber sale project is designed to include site-specific BMP prescriptions for the prevention of sedimentation and other stream damage from logging debris.

Some Precommercial Thinning (PCT) is proposed in RHCA's for this project. Mechanical equipment will not be operated in RHCA's; all RCHA PCT will be done by hand methods.

Implementation and responsibility: The Sale Preparation Forester is responsible for inclusion of the relevant clauses in the Timber Sale Contract and for ensuring that unit layout minimizes the number of channel crossings needed for the temporary transportation system. The Sale Administrator works with the Purchaser's representative to ensure that the Timber Sale Contract provisions covering the above items are carried out on the ground. Specialists can be called upon to help the Sale Administrator with decisions.

Ability to Implement: High

Effectiveness: High

Monitoring: Implementation will be documented by the Sale Administrator in the Timber Sale Inspection Report. Effectiveness of methods (if any) used to cross RHCA's will be monitored during post-sale reviews.

PT-9. Determining Ground-based Feasibility

Objective: To protect water quality from degradation caused by ground-disturbing machinery (i.e. tractors, excavators, processors, and forwarders).

Explanation: Tractor logging is restricted to lands that can be harvested with a minimum of soil compaction and erosion. Factors considered when selecting tractor operable land are: slope, topography, soil texture, soil drainage, and drainage pattern.

Limit the slopes where tractors may operate. Ground-based equipment will be limited to slopes less than 35%. Short pitches may be steeper. Avoid long steep skid trails. This applies to all units.

Cut-to-length (CTL) logging will be limited to slopes less than 40%. Short pitches may be steeper, such as the access from the road. This applies to all units.

The determination whether any given treatment area would provide enough slash to be logged with a CTL would be done during the timber sale preparation phase, when the prescription is written and the timber

cruised. If it is determined that the stand will not generate enough slash, CTL logging would not be allowed unless some other buffer material is used (e.g. snow). If a treatment unit is too steep for a tractor, and would not provide enough slash for a CTL, it would use a skyline or helicopter yarding system.

Grapple piling used for post-harvest and fuels treatments will be held to the same standards as conventional tractor yarding equipment.

Implementation and responsibility: When designating skid trails, it is the responsibility of the TSA to avoid steep slopes and long, steep trails. Land suitable for tractor logging is identified in the pre-sale phase of the timber sale planning process. Provisions in the Timber Sale Contract specify the areas and conditions upon which tractors can operate. Requirements governing tractor operations are incorporated in the Timber Sale Contract.

Ability to Implement: High

Effectiveness: High

Monitoring: The Sale Administrator oversees the operation to ensure compliance. Also see Forest Plan monitoring guide.

PT-10. Log Landing Location

Objective: To locate landings in such a way as to minimize creation of hazardous watershed conditions.

Explanation: All landings will be approved prior to clearing, or will be located by the Forest Service, under provisions of the Timber Sale Contract. The following criteria are used in evaluating landings:

- a. The cleared or excavated size of landings shall not exceed that needed for safe and efficient yarding and loading operations.
- b. Landing locations will be selected on the basis of the least amount of excavation and erosion potential, where sidecast will neither enter drainages nor damage other sensitive areas.
- c. Landings will be located so that designated timber can be yarded with minimal disturbance to stream channels or violating RHCA requirements. Landings will not be located within RHCA's.
- d. Reuse landings that are already detrimentally compacted to the extent possible in order to avoid detrimentally compacting additional new areas. The landings that are easily recognized are detrimentally disturbed.

Implementation and Responsibility: The majority of landings are constructed by the Forest Service during road construction of specified roads. The Sale Administrator ensures that the landings are located and constructed according to the Timber Sale Contract.

Ability to Implement: High

Effectiveness: High

Monitoring: Post-harvest reviews consider whether the landing locations were appropriate. Also see Forest Plan monitoring guide.

PT-11. Skid Trail Location and Design

Objective: Skid trails will be designed to minimize soil compaction, erosion, and water runoff. No more than 20% of each treatment unit may have detrimental soil conditions including compaction, displacement, and erosion.

Explanation: Factors that will be considered in the design and location of skid trails include size of logs, slope, aspect, soil drainage and stability, exposure, RHCA's, meadows, and other factors that affect compaction, erosion, runoff, and sediment yield. The careful control of skidding patterns can minimize on-site compaction and off-site damage.

Reuse areas that are already compacted. To the extent possible, use existing detrimentally compacted skid trails and skid roads. The skid trails that are easily recognized are detrimentally disturbed. However, re-use of old, poorly designed trails will be avoided.

Minimize the compaction of new areas by designating trail spacing. For tractor units, the skid trails should be at least 130 feet apart. Tractors will be limited to skid trails; if necessary, logs will be winched to the trail. For CTL (cut-to-length) units, forwarder trails should be about 40 feet apart and effectively buffered with slash or snow. These spacing requirements apply except where trails converge at landings or as necessary to avoid rock outcrops or wetlands.

- If a CTL trail is buffered with slash, the slash will be placed on ground ahead of the timber-felling machine to minimize compaction; and the same trail will be used by the forwarder. The slash needs to average 12 inches deep prior to compaction by the equipment to provide sufficient soil buffer.
- If a CTL trail is buffered with snow, a snowpack of about 10-24 inches¹ will generally protect soil from compaction. Snow over frozen soil is the most effective.

Prevent compaction of areas outside of designated skid trails. Mechanized felling equipment will only be allowed to operate on designated skid trails. If the purchaser requests to use ground-based equipment off of designated skid trails, including use in skyline and helicopter units, the request will be reviewed and considered on a case-by-case basis. This applies to all units.

The following project specific modifications apply:

Units SDB and SDA will be harvested only when soil conditions will remain within standards and guidelines, in order to protect a private downslope water source on a tributary of Rocky Creek. Pre-harvest monitoring has been conducted to determine the existing condition and the need for subsequent monitoring during timber harvest operations.

Implementation and Responsibility: Sensitive areas, including steep and unstable ground, drainages, and high water table soils are identified in the soils report, silvicultural prescriptions, and logging plans. The Sale Administrator locates the skid trails with the timber Purchaser or by agreeing to the Purchaser's proposed locations prior to construction.

Ability to Implement: High

Effectiveness: High for 1st entry units; Moderate for 2nd entry units.

Monitoring: The Sale Administrator observes operations and watershed specialists visually monitor implementation of this BMP periodically throughout implementation. Representative second entry units will be assessed after the sale for exceedances of the soil disturbance standard. Also see Forest Plan monitoring guide.

PT-12. Suspended Log Yarding in Timber Harvesting

Objective: To protect soils from excessive disturbance, and to maintain the integrity of RHCA's and other sensitive watershed areas.

Explanation: Suspended log yarding only applies to skyline and helicopter yarding systems. Ground disturbance is reduced by suspending logs either partially or wholly above the ground while transporting them to the landing. These yarding systems require fewer roads and generally result in less impact soil and water resources.

Suspend logs while cable or skyline yarding. One end would generally be suspended to keep the forest floor intact. One-end suspension may not be feasible in the vicinity of rock outcrops and "knobs". This applies to all skyline and cable units, and portions thereof.

The follow project-specific modifications apply:

¹ The snow depth is to be measured in the openings. This is expected to equal about 12-14 inches of snow under the tree canopy.

If yarding over streams or wetlands occurs, trees must be fully suspended over the stream for a minimum distance of 60 feet on either side of the edge of the stream or wetland.

One end suspension may not be possible in the vicinity of "blind leads." Intermediate supports may be required to protect sensitive resources.

Implementation and Responsibility: Areas to use suspended log yarding are determined during the environmental analysis, documented in the EA, and included in the sale plan or analysis files. These specific systems are required in the Timber Sale Contract and designated on the Sale Area Map by the Sale Preparation Forester. The Sale Administrator oversees the project operation using the guidelines and standards established in the Timber Sale Contract.

Ability to Implement: High

Effectiveness: High

Monitoring: Post-harvest reviews. Also see Forest Plan monitoring guide.

PT-13. Erosion Prevention and Control Measures During Timber Sale Operations

Objective: To ensure that the Purchaser's operations shall be conducted to minimize soil erosion and sediment transport to streams.

Explanation: Equipment shall not be operated when ground conditions are such that excessive damage will result. The kinds and intensity of control work done by Purchaser shall be adjusted to ground and weather conditions and the need for controlling runoff. Erosion control work shall be kept current immediately preceding expected seasonal periods of precipitation or runoff. The TSC will include contract clauses to protect water quality

Implementation and Responsibility: The Sale Administrator and Forest Service Representative oversee implementation. Specialists are available for advice as needed.

Ability to Implement: High

Effectiveness: High

Monitoring: TSA and ER will report ground conditions in daily documentation. See Forest Plan monitoring guide.

PT-14. Revegetation of Areas Disturbed by Harvest Activities

Objective: To establish a vegetative cover on disturbed sites to prevent erosion and sedimentation.

Explanation: Where soil has been severely disturbed by the Purchaser's operations, and the establishment of vegetation/cover is needed to minimize erosion and protect water quality, the Purchaser shall take appropriate measures normally used to establish an adequate cover of grass or other vegetation, including the application of seed or other agreed upon stabilization measures. This usually occurs on landings, skid trails, and in some skyline corridors.

For tractor units, designated skid trails and landings will be scarified and seeded after use.

For CTL/forwarder units, trails will generally not be scarified because of the slash cover. Bare areas on these trails will be seeded.

For cable/skyline units, seed and scarify landings and seed any highly disturbed skyline corridors.

For post-sale activities, the Contractor or Forest Service will take the appropriate measures to establish vegetative cover.

Implementation and responsibility: An estimate of the need is included in the timber sale appraisal and included in the TSC. The Forest Service will annually designate on the ground the disturbed soils that must be treated.

The Forest Service will provide requirements as to soil preparation and the application of suitable seed

mixtures, mulch, and fertilizer, and the timing of such work. It is the responsibility of the Sale Administrator or COR to make sure that revegetation work is done correctly and in a timely manner.

Ability to Implement: High

Effectiveness: High

Monitoring: Post-harvest reviews

PT-15. Log Landing Erosion Prevention and Control

Objective: To reduce the impacts of erosion and subsequent sedimentation from log landings.

Explanation: This practice uses administrative, preventive, and corrective controls to meet the objective. Design landings to facilitate drainage and erosion control. Use existing roads and landings if suitable.

Implementation and responsibility: Timber Sale Contract requirements provide for erosion prevention and control measures on all landings. Provisions are made in the Timber Sale Contract for landings to have proper drainage. After landings have served the Purchaser's purpose, the Purchaser shall ditch or slope the landings to permit the drainage and dispersion of water. Provisions are also made for revegetation, if necessary. The specific work needed on each landing will depend on the actual ground conditions. It is the responsibility of the Sale Administrator to ensure that this practice is properly implemented on the ground.

Ability to Implement: High

Effectiveness: High

Monitoring: Post-harvest reviews

PT-16. Skid Trail Erosion Control

Objective: To protect water quality by minimizing erosion and sedimentation derived from skid trails.

Explanation: The Timber Sale Contract requires the installation of erosion control measures on skid trails and cable corridors. Normally, the work involves constructing cross ditches and water-spreading ditches. Other methods such as back-blading may be agreed to in lieu of cross drains. Grass seeding, mulching, or spreading of slash may also be required.

Implementation and responsibility: The Sale Administrator ensures that the Purchaser completes and maintains the erosion control work specified in the Timber Sale Contract.

Ability to Implement: High

Effectiveness: High

Monitoring: The TSA or COR will monitor implementation during operations. Implementation and effectiveness will be included in post-harvest reviews.

PT-17. Meadow Protection During Timber Harvesting

Objective: To avoid locating roads, landings, and skid trails in "wet" meadows.

Explanation: To protect watershed and wildlife values, roads should not be located in wet meadows except on pre-existing road templates. Wet meadows or wetlands are those areas that are inundated by surface or ground water with a frequency sufficient to support a prevalence of vegetation or aquatic life that requires saturated or seasonally saturated soil conditions for growth.

The following project-specific modifications apply:

Meadows adjacent to units ECJ, SDP, SDQ, and DCI will be protected.

Do not allow purchasers to park vehicles or store equipment in wet meadows.

Implementation and Responsibility: Sensitive areas are identified in silvicultural prescriptions and logging plans. The TSA locates skid trails with the Purchaser or by agreeing to the Purchaser's proposed locations prior to construction.

Ability to Implement: High

Effectiveness: High

Monitoring: The Sale Administrator will monitor implementation during harvest operations. Also see Forest Plan monitoring guide.

PT-18. Erosion Control Structure Maintenance

Objective: To ensure that constructed erosion control structures are stabilized and working.

Explanation: Erosion control structures are only effective when they are in good repair and stable condition. Once constructed and seeded, there is a possibility that they may not become adequately vegetated or they may be damaged by subsequent entries. Follow-up inspection and structural maintenance are necessary in order to ensure adequate erosion control.

Implementation and responsibility: The Purchaser will provide maintenance of soil erosion control structures constructed by the Purchaser until released under the terms of the TSC. The TSA oversees the Purchaser's implementation of the BMP. The Forest Service may accomplish erosion control maintenance through watershed restoration after the TSC closes.

Ability to Implement: High

Effectiveness: High

Monitoring: Watershed specialists will monitor the effectiveness of erosion prevention and control measures.

PT-19. Acceptance of Timber Sale Erosion Control Measures Before Sale Closure

Objective: To assure the adequacy of required erosion control work on timber sales.

Explanation: The effectiveness of soil erosion prevention and control measures is determined by the results found after sale areas have been exposed to the elements for one or more years. Although a careful check is required before a timber sale is closed to assure that planned erosion work has been completed to the standard prescribed, the erosion prevention work done in previous years should be periodically inspected during the life of the timber sale. These inspections will help determine whether the planned work was adequate, if maintenance work is needed, the practicability of the various treatments used, and the necessity for modifying present standards or procedures.

Implementation and responsibility: Specific requirements for erosion control are included in the Timber Sale Contract(s). Sale administrators will ensure erosion control measures comply with the TSC.

Ability to Implement: High

Effectiveness: High

Monitoring: Watershed specialists will monitor the effectiveness of erosion prevention and control measures.

PT-20. Reforestation

Objective: To assure adequate regeneration on all suitable land harvested, and/or to promptly reforest all other suitable areas not harvested but in need of reforestation.

Explanation: Harvest units that do not meet regional stocking standards after harvest shall be site-prepped, as needed, for natural regeneration and supplemented with planted nursery seedlings. This will

comply with requirements of the National Forest Management Act, which requires Forests to assure adequate stocking levels on all lands within five years after harvest. The implementation of this practice affects water quality by helping to stabilize soils, increase ground cover, and provide improved infiltration.

Site preparation for natural regeneration shall be accomplished using a low ground pressure (less than 6 lbs. per square inch), track-mounted grapple. Soil disturbance for seedbed preparation shall be confined to the minimum required for adequate regeneration. Fuels within these cutting units may be piled for fuels hazard reduction if post-harvest reviews indicate a high fuels hazard exists. Interplanting with genetically superior nursery stock may be used to supplement natural regeneration.

The following project-specific modification applies:

Grapple pile equipment will normally be limited to skid trails.

12-14 tons/acre shall be left in a variety of size classes to maintain long term site productivity.

Implementation and responsibility: The silviculturist is responsible for determining regeneration needs and methods.

Ability to Implement: High

Effectiveness: High

Monitoring: Regeneration and stocking surveys will be done by the Forest Service to verify the success of the reforestation.

PT-21. Servicing and Refueling of Equipment

Objective: To prevent pollutants such as fuels, lubricants, bitumens, raw sewage, wash water and other harmful materials from being discharged into or near rivers, streams and impoundments or into natural or man-made channels leading thereto.

Explanation: During servicing or refueling, pollutants from logging or road construction equipment have the potential, in some instances, to enter a watercourse. This threat will be minimized by selecting service and refueling areas well away from wet areas and surface water (outside of RHCA's), and by using berms around such sites to contain spills. A Spill Prevention Control and Countermeasures (SPCC) Plan, certified by a registered professional engineer, will be required if the volume of fuel storage at a site exceeds 1320 gallons in containers of 55 gallons or larger.

Implementation and Responsibility: The Contracting Officer's Representative, Engineering Representative, or Sale Administrator will designate the location, size and allowable uses of service and refueling areas. They will also be aware of emergency notification procedures and actions to be taken in case of a hazardous substance spill.

Ability to Implement: High

Effectiveness: High

Monitoring: The TSA and ER will monitor compliance with servicing and refueling of equipment.

PT-22. Modification of the Timber Sale Contract

Objective: To modify the Timber Sale Contract if new circumstances or conditions arise and indicate that the timber sale will irreversibly damage soil, water or watershed values.

Explanation: Once timber sales are sold, they are harvested as planned via the Timber Sale Contract. At times, however, it may be necessary to modify a Timber Sale Contract when it is determined that operations would cause serious environmental damage. If new evidence indicates that unacceptable damage is likely to occur, an interdisciplinary team will assess the evidence and implications, and make recommendations to the appropriate line officer.

The EA may then be amended to reflect the findings of the interdisciplinary team. The team will make

recommendations to the appropriate line officer on whether the timber sale, as currently planned, will: (1) irreversibly damage soil, water or watershed conditions, or (2) inadequately protect streams, streambanks, shorelines, lakes, wetlands, and other bodies of water from detrimental changes in water temperatures, blockages of watercourses, and deposits of sediment.

Implementation and responsibility: If the TSC, as determined by the appropriate line officer, will unacceptably affect watershed values, the sale will be modified to protect the watershed through agreement with the timber sale Purchaser; or the contract may be terminated by the Chief of the Forest Service, if the Purchaser does not agree to the terms of the environmental modification.

Ability to Implement: High

Effectiveness: High

Monitoring: EA post-harvest reviews. Also see Forest Plan monitoring guide.

PT-23. Temporary Road Design and Erosion Control

Objective: To minimize soil compaction, erosion, and water runoff from temporary roads.

Explanation: The term “Temporary” is a Forest Service Timber Sale Contract term used to define roads to be constructed by the timber purchaser for the sole purpose of aiding in the harvest of a specific unit. Some temporary road locations are identified in the transportation plan and are mapped and listed with the proposed new construction. Most temporary road locations are determined at the time of harvest unit layout. Temporary roads usually have less clearing and less excavation and are built on flatter ground. Temporary roadbeds are obliterated or, at a minimum, properly drained, scarified and revegetated, and entrances are blocked when timber sale use is done.

The following standards apply to temporary road location and design.

- a. Short term, single purpose road needed for one project or resource activity.
- b. Road will not be needed in the next twenty years.
- c. Difficulty of construction is low with minimal resource impact. The road has little or no rock blasting; template located on flatter side slopes, not within perennial RHCA's, and no need for tight control of construction or location.
- d. No special design standards are needed for construction such as special sediment reduction methods, lowboy access, rock surfacing, or large culverts/bridges.
- e. Length generally under 0.5 mile.
- f. Road will not be extended in future entries.
- g. Temporary roads will not be constructed in RHCA's unless no other feasible alternative exists. If construction in an RHCA is deemed necessary, the sale administrator will consult with road engineering and/or watershed staff to determine the location and appropriate standards (such as construction methods and timing) for the crossing structure.
- h. When available, reuse existing roads, unclassified roads, and landings to minimize detrimentally impacts to new areas.

Erosion control measures include (and are not limited to):

- a. The Timber Sale Contract requires the installation of erosion control measures on temporary roads. Normally, the work involves constructing cross ditches and water-spreading ditches. Other methods such as back-blading may be agreed to in lieu of cross drains.
- b. Temporary roads will be scarified and reseeded after use.

Implementation and responsibility: The sale administrator must approve, in advance and on the ground, the location of temporary roads. The Purchaser is obligated to complete and maintain erosion control work specified in contract provisions. The Sale Administrator ensures that the Purchaser completes and maintains the erosion control work specified in the Timber Sale Contract.

Ability to Implement: High

Effectiveness: High

Monitoring: Watershed specialists assist the TSA to evaluate the effectiveness of this BMP. See Forest Plan Monitoring Guide

TRANSPORTATION SYSTEM BMP'S

PR-1. General Guidelines for the Location and Design of Roads

Objective: To locate and design roads which will have minimum resource damage.

Explanation: Road location and design standards will be based on the intended road purpose and the protection of aquatic resources.

General road location standards will include:

- a. Traffic Service Level (TSL) "D" roads with design speed of 10 mph or less will be located on a predominately non-geometrical horizontal and vertical alignment to minimize the amount of excavated material needed to construct the road.
- b. New The road grade will be rolling when possible between control points to provide roadbed drainage.
- c. Generally roads should be located on flatter side slopes over steeper side slopes to limit soil movement outside of the road clearing limits.
- d. Generally roads should be located to utilize existing old road prisms rather than on "undisturbed" ground to minimize the amount of new slope construction.
- e. New road alignments should enter and leave Riparian Habitat Conservation Areas (RHCA) in as short a length as possible given the constraints at the crossing location for relieving roadway drainage and road alignment into and out of the RHCA.
- f. Generally new stream crossings should be located in areas of lower stream gradient over areas of higher stream gradient to limit the amount of scour protection needed at the drainage structure outlet and in Category 1 RHCA, make it easier to provide for upstream fish passage through the drainage structure.
- g. Generally try to minimize the number of stream crossings as determined by site specific analysis.
- h. When available, reuse existing roads, unclassified roads, and landings to minimize detrimentally impacts to new areas.

Road design standards will include:

- a. Road design standards will be the minimum necessary to meet user and resource needs.
- b. New stream crossings will be designed to pass a 100 year flood flow.
- c. New stream crossings in Category 1 RHCA will be installed to provide for upstream fish passage.
- d. Roadway drainage should be designed so that water concentrated by the road prism is dispersed prior to entering stream channels.
- e. Roads in Category 1, 2 and 4 RHCA's will be designed so that stream flows will not be diverted down the road in the event of a crossing failure.
- f. In ephemeral draws (swales) the designed drainage should generally be self-maintaining (such as a drain dip or outsloped drain). Generally use culverts in ephemeral draws where the cost of stabilizing the roadbed and fill slope on drain dips and OSD are greater than for the culvert installation with scour protection.

Implementation and Responsibility: Road location standards will be implemented by the Project Transportation Planner. Road design standards will be implemented by the Road Designer.

Ability to Implement: Moderate for location because site specific analysis may allow deviations from the general guidelines. High for design because there are set tightly controlled processes for checking design work.

Effectiveness: High where the new construction road location can limit the area of cut and fill slopes and the number of stream crossings.

Monitoring: Location and design standards will be monitored by the Forest Engineer or his designate in tagline reviews and the engineering road contract review process.

PR-2. Erosion Control Plan Submittal, Approval, and Application

Objective: To limit and mitigate erosion and sedimentation through effective planning prior to initiation of road construction activities and through effective contract administration on planned methods during construction.

Explanation: Road reconstruction and temporary road construction usually result in short term erosion. By effectively planning for erosion control, sedimentation can be minimized. This erosion control plan should include measures such as silt fences and hay-bale barriers to prevent sediment from entering streams, and revegetation of disturbed areas. Where possible, topsoil will be conserved and replaced on cuts and fills to promote revegetation and aid erosion control.

Implementation and Responsibility: An Erosion Control Plan, prepared by the Purchaser, is required by contract provisions. Operations cannot begin until the Forest Service has given written approval of the plan. The plan recognizes the mitigation measures required in the contract. All contracts specify that operations be scheduled and conducted to minimize erosion.

Ability to Implement: High

Effectiveness: High

Monitoring: The Engineering Representative will monitor the effectiveness of the operating plan and construction to reduce erosion. The Engineering Representative will document findings in the contract daily diary or final inspection report.

PR-3. Timing of Construction Activities

Objective: To minimize erosion by conducting road reconstruction and construction operations during minimal runoff periods.

Explanation: Since erosion and sedimentation are directly related to runoff, scheduling operations during periods when the probabilities for rain and runoff are low is an essential element of effective erosion control. Contractors are to schedule and conduct operations to minimize erosion and sedimentation. Equipment will not be operated when ground conditions are such that excessive damage will result. Such conditions are identified by the Contracting Officer's Representative or Engineering Representative with the assistance of watershed specialists. Road construction and reconstruction work will be accomplished in the Normal Operation Season specified in the TSC. Work may be accomplished outside this time period subject to the written approval of the Contracting Officer.

In addition, it is important to keep erosion control work as current as practicable with ongoing operations during anticipated runoff periods. Construction of drainage facilities and performance of other contract work which contribute to the control of erosion and sedimentation shall be carried out in conjunction with earthwork operations, or as soon thereafter as practicable. The contractor should limit the amount of area not graded to drain at any one time, and should install permanent drainage structures as soon as practical.

Implementation and Responsibility: The Road Designer is responsible for assuring applicable specifications are used in the Timber Sale Contract, with the appropriate road construction operating season dates identified. The Engineering Representative is responsible for assuring that the reconstruction or construction is accomplished in conformance with the plans, specifications and contract clauses.

Ability to Implement: Moderate since the Engineering Representative does not have 100% control over the timely placement of erosion control structures.

Effectiveness: High compared to having an uncontrolled amount of road in an incomplete state outside the normal operating season.

Monitoring: The ER will monitor the effectiveness of this BMP and document findings in the contract daily diary during the road review process.

PR-4. Location, Design and Construction of Stable Road Cut and Fill Slopes

Objective: To minimize long term soil erosion by locating, designing and constructing road slopes and waste areas to minimize slope failures and soil movement from the clearing limits.

Explanation: General road location standards which would effect the stability of constructed cut and fill slopes, and waste areas include the following:

- a. As with BMP PR-1, generally locate roads and waste areas on flatter side slopes over steeper side slopes to minimize the cut and fill slope area.
- b. Avoid where possible, road locations on inner gorge areas with side slopes over 60% to minimize cut and fill slope area and the risk of intercepting subsurface water in or adjacent to RHCA.
- c. Avoid where possible, road locations which would intercept subsurface water on side slopes over (approximately) 30% to minimize the risk of long term failure in constructed cut slopes.
- d. Avoid road locations through land forms which show mass movement where the Forest Geotechnical Engineer estimates there is a high probability of continued mass soil movement.

Road design standards for stable cut and fill slopes, and waste areas include the following:

- a. The road designer will design to the steepest slope ratio for a given soil type which is mechanically stable given dry conditions and gives a seed bed which will reliably hold seed on the slope given a seed application method.
- b. Revegetate cut and fill slopes, waste areas and ditches as a minimum. Areas where cut and fill slopes are to be constructed in highly erodible material should be identified in the preconstruction design walk phase, and special revegetation measures should be designed for these areas.
- c. Seed concentrations and application methods should be sufficient to achieve revegetation of the roadway within 3 years of application.
- d. Where roadbed drainage is concentrated on fill slopes the slope should be armored or filter material placed on it. This standard applies to new road construction. The road designer should evaluate the need for existing fill slope protection when adding drainage structures to existing roads.
- e. Cut slopes with subsurface water present may be stabilized by flattening the slope ratio for slopes under 2' in height or buttressed for slope heights over 2'. Where buttressing is utilized, water coming out of the slope should be filtered to prevent piping of material from the slope into roadway drainage.
- f. Generally waste areas should be located on flatter side slopes over steeper side slopes. Concentrated sidehill or roadway drainage should not be dumped onto the waste area. Waste area slopes should be graded so as not to concentrate water. Waste area slopes should be constructed no steeper than 1.5:1. Waste material should be compacted to a layer placed specification as a minimum with special attention given to compacting the fill faces leaving the slope face in a roughened condition.
- g. Embankments will generally be placed using side cast and end haul methods. Added compaction requirements may be required by the Forest Geotechnical Engineer for construction of major embankments to assure the mass stability of the embankment. Major embankments are those that are over 8 ft high and 100 ft long.
- h. Embankments should not be designed on side slopes over 70% for those materials whose angle of repose is at 1.25:1.

Construction standards for stable cut and fill slopes include the following:

- a. Excavated material should be controlled inside the construction limits as required in Specification 203. Special construction practices should be applied in areas where the ground slope is too steep to construct a stable fill on (generally ground slopes over 70%). The excavated material from these "Full-bench" areas should be end hauled to a road embankment or waste area as designated in the plans, and not sidecast outside the construction limits (unless site specific analysis determines otherwise).

- b. Cut slopes should not be "undercut" at the bottom of the slope to create material for roadbed finishing thereby destabilizing the whole slope.
- c. Cut slopes should be left in a roughened condition as cut by the cat or excavator to give places for erosion control seed to catch and sprout.

Implementation and Responsibility: The TRANSPORTATION PLANNER is responsible for locating roads and making the needed contacts with appropriate resource specialists to meet the above standards. The ROAD DESIGNER is responsible for assuring the appropriate field work is completed prior to design and for designing roads to the above standards. The ROAD DESIGNER is responsible for incorporating input from resource specialists. The Engineering Representative is responsible for administering the plans and specifications which apply the above standards on the ground.

Ability to Implement: Moderate given the variability of subsurface water conditions.

Effectiveness: High

Monitoring: The Engineer who reviews the design certifies the implementation of the BMP. Watershed specialists, road designers and Forest Staff will monitor the effectiveness of specific practices on a forest-wide basis and results will be reported or referenced in the annual Forest Monitoring Report.

PR-6. Dispersion of Subsurface Drainage Associated with Roads

Objective: To minimize the possibilities of roadbed, cut and fill slope failure and the subsequent production of sediment.

Explanation: On existing roads where seasonal subsurface flow occurs in the roadbed and traffic use would produce soil movement outside the clearing limits, traffic management will be the first action taken to limit soil movement. The road will be reconstructed where traffic management will not effectively regulate subsurface flows and limit soil movement to the clearing limits.

The following are some dispersion methods that can be used:

- a. pipe underdrains
- b. horizontal drains
- c. stabilization trenches
- d. drainage blankets or rock drains
- e. ditches
- f. stabilization fabric and ballast material

Dispersal of collected water should be accomplished in an area capable of withstanding increased flows. On most soils, energy dissipaters need to be placed at pipe outlets as a preventative practice.

On new road construction, subsurface flows should be avoided by the road location where feasible. Similar design solutions may be used as for reconstruction of existing roads. See further direction for cut slope excavation in BMP PR-4.

Implementation and Responsibility: The Road Locator will be responsible for avoiding areas with evident subsurface flow where feasible. The Road Designer will be responsible for accomplishing sufficient field work to determine where perennial subsurface flow is affecting existing roads and where evident subsurface flow is occurring along new construction alignments as a minimum. The Road Designer is responsible for designing appropriate measures to limit soil movement due to subsurface flow to within the clearing limits. For those cases where subsurface flow is discovered in construction, the Engineering Representative is responsible for designing the appropriate measures for limiting soil movement to the clearing limits. The Engineering Representative and FOREST SERVICE REPRESENTATIVE are responsible for managing commercial traffic under the Timber Sale to minimize roadbed damage where subsurface flow is present.

Ability to Implement: High since these are standard forest practices.

Effectiveness: Moderate due to some subsurface drainage problems not being evident until roads are constructed.

Monitoring: Plan-in-hand review, design review, and road construction review process. The effectiveness of traffic management will be documented by the Engineering Representative or FOREST SERVICE REPRESENTATIVE contract daily diaries.

PR-7. Control of Surface Roadway Drainage

Objective: (1) To minimize the erosive effects of water concentrated by road drainage features, (2) to disperse run-off from the road, and (3) to minimize soil movement outside the road clearing limits.

Explanation: Runoff from the road template will be directed off the roadway and ditch relief will be provided at short enough intervals (based on soil type) that soil movement will be minimized outside the road clearing limits. Where it is impractical to relieve drainage over short intervals, ditches and roadbeds should be armored. The "Guideline for Controlling Sediment for Secondary Logging Roads" can be used as a guide to determine spacing of drainage structures based on soil type. Refer to BMP PR-4 for slope protection requirements where concentrated water is channeled onto cut and fill slopes.

Riprap should be used at outlets of drainage facilities for energy dissipation. Aggregate can be placed on roads with steep grades and non-cohesive soils. All contributing road segments within Category 1 through 4 RHCA's will be rocked unless native material provides adequate protection. Filter concentrated water from drain dips to minimize soil movement. Filter windrows and brush blankets are preferred filtration structures. Minimize the size of drainage area draining directly into RHCA.

Implementation and Responsibility: The ROAD DESIGNER is responsible for determining the soil type and for applying the above guidance in the design and spacing of drainage structures and armoring. The Engineering Representative will make on-the-ground adjustments during construction to meet objectives.

Ability to Implement: High since this is standard forest practice.

Effectiveness: High

Monitoring: The Engineering Representative is responsible for monitoring and documenting the effectiveness of these measures.

PR-8. Constraints Related to Pioneer Road Construction

Objective: To minimize sediment production and mass wasting problems associated with pioneer road construction.

Explanation: To meet the objective of minimizing sediment, the following constraints should be followed when constructing pioneer roads in the Project Planning Area:

- a. Construction of pioneer roads shall be confined to the final roadway construction limits, unless otherwise approved by the Engineering Representative. Excavation shall be conducted so as to prevent undercutting the final cut slope and to minimize depositing materials outside the designated roadway limits.
- b. Erosion control work will be completed prior to periods of seasonal precipitation and then kept up daily as work progresses when operations occur outside the normal operating season.
- c. Stream crossing structures will be installed prior to equipment crossing a live stream. During installation, water will be diverted in compliance with Washington State HPA requirements.

Implementation and Responsibility: The Engineering Representative is responsible for administering the contract to address the above requirements. The purchaser or contractor will be responsible for implementing mitigation measures. Compliance with plans, specifications, and operating plans is determined with tests, measurements, and observations by the Engineering Representative. The mechanisms for implementing and enforcing this BMP are Forest Service Road Construction Specifications and the Stewardship/Timber Sale Contract provisions.

Ability to Implement: Moderate since the Engineering Representative is not on site at all times.

Effectiveness: Moderate

Monitoring: The Engineering Representative is responsible for monitoring the effectiveness of the BMP. Monitoring will be documented in contract daily diaries.

PR-9. Timely Erosion Control Measures on Incomplete Roads and Stream Crossing Projects

Objective: To minimize erosion of and sedimentation from disturbed ground on incomplete projects.

Explanation: Protective measures must be applied to all areas of disturbed, erosion-prone, unprotected ground. When conditions permit operations outside of the dry season, erosion control measures must be kept current with ground disturbance to the extent that the affected area can be rapidly "closed" if weather conditions deteriorate. Areas should not be abandoned for the winter with remedial measures incomplete. Preventive measures include:

- a. Removal of temporary culverts, culvert plugs, diversion dams or elevated stream crossing causeways;
- b. Installation of temporary culverts, side drains, flumes, cross drains, diversion ditches, energy dissipaters, dips, sediment basins, berms, debris racks or other facilities needed to control erosion;
- c. Removal of debris, obstructions, and spoil material from channels and floodplains;
- d. Grass seeding, placement of hay bales or silt fencing, and mulching.

Implementation and Responsibility: Mitigation measures and their location are developed and documented during the environmental analysis process using an interdisciplinary approach. Contracted projects are implemented by the Contractor or Purchaser. Compliance with project plan criteria, contract specifications, and operating plans is determined with tests, measurements, and observations by the Contracting Officer's Representative or Engineering Representative. The mechanisms for implementing and enforcing this BMP are Forest Service Road Construction Specifications.

Ability to Implement: High

Effectiveness: High

Monitoring: The Engineering Representative or Contracting Officer's Representative will review road construction and document their observations. See Forest Plan Monitoring Guide, Item 25B: Watershed Best Management Practices, and Item 26: Riparian Areas.

PR-11. Title: Control of Sidecast Material

Objective: To minimize sediment production originating from sidecast material during road reconstruction and maintenance.

Explanation: Unconsolidated sidecast material can be difficult to stabilize and is susceptible to erosion, settling, and mass instability. No significant sidecasting is anticipated. During road maintenance operations, the deposition of sidecast material shall be done where it will not weaken stabilized slopes.

Implementation and responsibility: Contracted projects are implemented by the Contractor or timber sale operator. Compliance with project criteria, contract specifications, and operating plans is determined with tests, measurements, and observations by the COR, ER, or maintenance engineer. Contracts and guidelines address slide and slump repair, surface blading, and the placement of waste road material to reduce sidecasting.

Ability to Implement: High

Effectiveness: High

Monitoring: Road design review, progress review during construction, and maintenance activity reviews.

PR-12. Location, Design and Control of Road Construction in Riparian Habitat Conservation Areas (RHCA's)

Objective: To reduce the adverse effects of sedimentation from nearby roads on slope stability, vegetation, and aquatic resources in riparian areas.

Explanation: RHCA's are described in BMP PT-7. See BMP PR-1, PR-4 and PR-7 for additional measures that refer to road work in RHCA's. Location, design and construction practices within these areas include the following measures.

Road location standards for RHCA's will include:

- a. Locate waste areas outside of RHCA's.
- b. Road locations in RHCA's will be avoided whenever feasible.

Road design standards for RHCA's will include:

- a. Where run-off cannot be effectively filtered by the forest floor, artificial sediment detention structures and/or erosion control measures such as brush blankets, filter windrows or fences, riprap blankets or sediment basins should be installed. Slash generated by construction may be placed in slash mats mulching the fill slope.
- b. Minimize length of road surface and ditch line draining directly to stream channels.
- c. Protect road crossing by armoring with surfacing and other methods to withstand the 100-year flood. Native material may provide adequate protection.
- d. Roads crossing streams and RHCA's will be designed such that stream flow is not diverted down the road in the event of high flow and crossing failure.

Road construction standards for RHCA's will include:

- a. See BMP PR-2 for minimum construction methods required for construction in RHCA's.
- b. Stream crossings will be constructed during periods of low flow. Water flowing into the construction area will be diverted around the area prior to pioneer road construction across the RHCA. Diverted water will be filtered prior to flowing back into the creek.
- c. Culverts will be bedded into the streambed sufficiently to avoid piping under the culvert. Construct energy dissipaters at culvert outlets where necessary to provide scour protection for 100-year peak discharges. Culverts will be designed and placed to provide for upstream fish passage within Category 1 streams and RHCA's.

The following project specific modification applies:

Road locations (whenever feasible) will be at least 100 feet from the edge of isolated seeps or wet areas to minimize creating additional livestock access to these sensitive areas.

One culvert on a Category 1 stream that is currently preventing fish passage would be replaced under this decision, when funding becomes available.

Implementation and Responsibility: The ROAD LOCATOR will be responsible for applying the above standards for new road location. The ROAD DESIGNER will be responsible for applying the above design standards in the design of new construction and reconstruction roads. The Engineering Representative will be responsible for assuring that the road plans, specifications, operating plans, and contract clauses are implemented under the contract.

Ability to Implement: High for location and design due to the forest's review procedures. Moderate for construction since the Engineering Representative is not present on the construction site at all times.

Effectiveness: High; Research in Horse Creek, Id., showed that filter windrows reduced the amount of sediment eroded off fillslopes even compared to hydromulched fillslopes (Burroughs and King, 1989). Even 20% ground cover is credited with reducing cut and fillslope erosion by 1/3, according to the Washington Forest Practices Board's Standard Methodology for Conduction Watershed Analysis, 1994, p. B-29.

Monitoring: The Engineering Representative will monitor the effectiveness of construction standards in contract daily diaries.

PR-13. Title: Diversion of Flows Around Construction Sites

Objective: -To ensure that all stream diversions are carefully planned to minimize sedimentation.

Explanation: The project proposes to replace a 36 inch diameter culvert on FR 4300468 at MP 1.1 (Graham Creek). This is a fish-bearing stream. The existing culvert would probably be replaced with a 10 foot wide arch pipe. The stream channel would be diverted, either by excavating a temporary channel or culvert. The stream would be diverted for approximately 30 days. The work would occur in July and August at low stream flows.

Implementation and responsibility: The by-pass would be designed by the Road Designer. Appropriate permits would be obtained. The ER is responsible for implementation of the design and any additional mitigation.

Ability to Implement: High

Effectiveness: High

Monitoring: Progress review during construction and road construction review process.

PR-14. Title: Culvert Installation and Protection of Fisheries

Objective: To minimize sedimentation and turbidity resulting from excavation for 'in-channel' structures.

Explanation: The culvert on FR 7018000 on Rocky Creek may be replaced. It is possible some culverts on other reconstructed roads may also need replacement. Culvert replacement typically requires excavation, and waste material would be stockpiled at suitable locations. The 7018 culvert will require a diversion (BMP PR-13). Sediment producing materials will not be left within reach of anticipated flood flows. Installation of downstream sediment basins may be necessary.

Implementation and responsibility: Contracted projects are implemented by the Contractor or Purchaser. Compliance with project criteria and the operating plan is determined with tests, measurements, and observations by the Forest Service COR or ER through inspection.

Ability to Implement: High

Effectiveness: High

Monitoring: Road review

PR-15. Disposal of Right-of-Way and Roadside Debris

Objective: To ensure that debris generated during road construction is kept out of streams and to prevent slash and debris from subsequently obstructing channels, to prevent debris dams which obstruct fish passage or result in downstream damage from high water flows.

Explanation: As a preventive measure, construction debris developed along roads near streams or in RHCA's will be disposed of by the following means, as applicable:

- a. On-Site
 - i. Piling and Burning
 - ii. Chipping
 - iii. Burying
 - iv. Scattering
 - v. Windrowing
 - vi. Disposal in Cutting Units
- b. Removal to agreed upon locations

- c. A combination of the above.
- d. Large limbs and cull logs may be bucked into manageable lengths and piled alongside the road for fuel wood.
- e. Material will not be piled and burned within RHCA's.

Implementation and Responsibility: Disposal of right-of-way and roadside debris criteria are established in the project plan by the responsible forest official with the help of the interdisciplinary team. Disposal locations are identified in the project plan.

Contracted projects are implemented by the Contractor or Purchaser. Compliance with plans, specifications, and operating plans is determined with tests, measurements, and observations by the Forest Contracting Officer's Representative or Engineering Representative. Changes to disposal locations may require other resource personnel or interdisciplinary team review.

Ability to Implement: High

Effectiveness: High

Monitoring: The Forest Engineer verifies that BMPs are being met in the road plan. The Engineering Representative implements the road plan through contract administration, as documented in the contract daily diary. The Engineering Representative signs the final acceptance letter verifying that the road plan has been satisfactorily been met.

PR-16. Specifying Riprap Composition

Objective: To minimize sediment production associated with the installation and utilization of riprap material.

Explanation: Riprap is commonly used to armor streambanks and drainage ways from the erosive forces of flowing water. Riprap must be sized and installed in such a way that it effectively resists erosive water velocities. Stone used for riprap should be free of weakly structured rock, soil, organic material, and materials of insufficient size, all of which are not resistant to streamflow and would only serve as sediment sources. Riprap is commonly used at outlets of drainage facilities in erodible soils for energy dissipation.

Implementation and Responsibility: Project location and mitigation measures are developed through the road design process to meet the constraints and requirements of the project plan. Compliance with project criteria and operating plans is determined with test, measurements, and observations by the Contracting Officer's Representative or Engineering Representative.

Ability to Implement: High

Effectiveness: High

Monitoring: Design Review and progress reviews during construction.

PR-17. Water Source Development to Protect Water Quality

Objective: To minimize sedimentation from water source areas used by livestock and as pumping sites for fire suppression and dust abatement.

Explanation: Water source development may be needed to supply water for road construction, dust abatement, and fire control. Water source development should aim toward the construction of durable, long-term water sources, rather than the construction of temporary, expedient developments. Permanently designed sources will normally result in the lowest, long-term impact to the affected streams. Water developments are best reviewed by an interdisciplinary team, to help determine locations or processes that will minimize nonpoint source pollution.

Other considerations in the development of water sources are:

- a. Downstream flows should not be reduced so as to detrimentally affect aquatic resources, fish passage, or other beneficial uses.
- b. Small, temporary facilities for gathering water should be constructed of sandbags containing sand, or of materials and means that will not induce sediment in the stream.
- c. Overflow should go directly back into the stream.
- d. All temporary facilities for gathering water should be removed prior to periods of seasonal precipitation.
- e. Road approaches to the water source development should be located to minimize potential impacts in the RHCA. Approaches in contributing areas should be gravel surfaced to reduce the effects of spillage from washing sediment into the stream.
- f. The fish-bearing tributaries of Byers, Rocky, and Meadow Creeks shall not be used for water sources due to their small flows. The mainstem of these streams and Big Meadow Lake may be used as water sources.
- g. Screens will be required on suction hoses used to withdraw water. No obstructions to fish passage will be allowed when operating pumps in these fish-bearing streams.

Implementation and Responsibility: Sale Administrators and Engineering Representatives, in conjunction with a hydrologist and fisheries biologist, should evaluate streams in which water developments may be constructed. Water developments shall be stabilized by the end of the dry season to avoid resource damage. Project locations and mitigation measures are developed by the design engineer using an interdisciplinary approach to meet project objectives. Compliance with project criteria and the operating plan is determined with tests, measurements, and observations by the Contracting Officer's Representative or Engineering Representative.

Ability to Implement: High; brush disposal funds and range/watershed funds can be used to jointly construct these facilities.

Effectiveness: High

Monitoring: Implementation and apparent effectiveness of the BMP will be reviewed during post sale interdisciplinary reviews.

PR-18. Maintenance of Roads

Objective: To maintain roads in a manner which provides for water quality protection by controlling the placement of waste material, keeping drainage facilities open, and by repairing ruts and failures to reduce sedimentation and erosion.

Explanation: Road maintenance will be a required work activity for roads used under the Timber Sale Contract. Standard maintenance specifications with specific work requirements will be included in this timber sale contract, as applicable, for roadbed blading, ditch cleaning, culvert cleaning, roadbed clearing, and slide removal.

On road segments in or immediately adjacent to RHCA's, excess material removed from sloughed cutslopes or ditches, which cannot be worked into the road surface, will be hauled to a disposal site designated by the Forest Service.

After final road maintenance is completed, all disturbed road surfaces, including shoulders, will be grass seeded in accordance with the Colville National Forest Seeding and Planting Guide.

Implementation and Responsibility: The work is controlled by a Road Maintenance Plan. Maintenance levels for each road are documented in Road Management Objectives. Maintenance of timber sale roads is a Purchaser responsibility, commensurate with their use. The Forest Service will continue to maintain roads in the project area that are not under the jurisdiction of the timber sale.

Ability to Implement: Moderate, since the Engineering Representative and Sale Administrator are not present at all times to monitor road conditions and maintenance work.

Effectiveness: High

Monitoring: The implementation of road maintenance requirements is monitored by the SA through the life of the sale, and documented in the contract daily diaries. A final inspection of all contract work will be accomplished by the Forest Service before the Purchaser is relieved of contractual responsibilities.

PR-19. Title: Road Surface Treatment to Prevent Loss of Materials

Objective: To minimize the erosion of road surface materials and consequently reduce the likelihood of sediment production from those areas.

Explanation: Unconsolidated road surface material is susceptible to erosion during periods of precipitation. Likewise, dust derived from road use may settle onto adjacent water bodies.

Rocking of drain dips, RHCA's and their contributing areas, rocking of roadbed for sediment control and subgrade strength is included in all reconstruction proposed.

Implementation and responsibility: The Road Designer will determine the locations requiring rock and include these areas in the contract. Contracted projects are implemented by the Contractor or Purchaser. Compliance is monitored by the COR or ER.

Ability to Implement: High

Effectiveness: High

Monitoring: Road construction review process.

PR-20. Traffic Control During Wet Periods

Objective: To minimize road surface damage and rutting, and lessen sediment washing from road surfaces.

Explanation: Roads in the project shall not be used for hauling or any other harvest-related activity when conditions are such that excessive damage or erosion may result. Purchaser operations will be restricted by the provisions in the Timber Sale Contract that provide for resource protection. Resource damage includes local damage that contributes sediment outside of the road prism. This may include a single soft, moist spot where displaced soil would move into a stream channel, wetland, or pond, even when the majority of a road system is trafficable. Such roads will be closed until a Forest Service Representative, Sale Administrator, or Engineering Representative determines that conditions have improved enough that the road can be used with a minimum of resource damage.

The following project-specific measure applies:

If intermittent streams are crossed on soft fords, haul will be limited to dry soil, snow-covered, or frozen ground conditions.

Implementation and Responsibility: The Sale Administrator or Engineering Representative will be responsible for controlling purchaser use of forest roads under this timber sale.

Ability to Implement: Variable; Sale Administrator is not constantly on the project to react to changes in

weather and purchaser's timely response to changes in road stability.

Effectiveness: High

Monitoring: The Sale Administrator will monitor the purchaser's implementation of this BMP and document findings in the contract daily diaries.

PR-21. Snow Removal Controls to Avoid Resource Damage

Objective: To minimize the impact of melt water on road surfaces and embankments, and to reduce sediment production resulting from snow removal operations.

Explanation: If roads in the timber sale are used during the winter for any harvest-related activity, the following measures will be employed to meet the objectives of this practice:

- a. The contractor is responsible for snow removal in a manner that will protect roads and adjacent resources.
- b. Snow berms will be removed or breached to avoid accumulation or channelization of melt water on the road and prevent water concentration on erosive slopes or soils.
- c. If the road surface is damaged, the contractor or permittee shall replace lost aggregate with similar quality material and repair structures damaged in blading operations, unless otherwise agreed to in writing.

Implementation and Responsibility: Compliance with developed criteria and the operating plan will be determined with tests, measurements, and observations by the Forest Service Representative, Engineering Representative, or maintenance engineer. The mechanisms for implementing and enforcing the BMP are standard contract provisions.

Ability to Implement: High

Effectiveness: High

Monitoring: Forest road management inspection trips. See implementation section for tracking. See Forest Plan Monitoring Guide

PR-22. Restoration of Borrow Pits and Quarries

Objective: To minimize off-site movement of sediment from borrow pits and quarry sites. To ensure that concentrated water draining from the pit area is dispersed or properly controlled to protect slopes and streams from erosion.

Explanation: Borrow pits and quarries are sometimes susceptible to erosion due to steep sideslopes, lack of vegetation, or their proximity to watercourses. Wherever necessary, prior to removal of rock, topsoil should be saved in a stockpile for surface dressing during pit reclamation. Once excavation has been completed on all or part of the area, the backslopes of the pit will be sloped back to their natural angle of repose in order to reduce erosion. The pit will be restored to the specifications listed in the pit plan including seeding, mulching, and drainage. Access roads to the site shall be treated as required in the plans and specifications.

Implementation and Responsibility: Borrow pit location and mitigation measures (such as the pit plan) will be developed through the road design process, using an interdisciplinary approach. The FSR or ER determines compliance with project criteria, contract specifications, and operating plans.

Ability to Implement: High

Effectiveness: High

Monitoring: Will be accomplished using the NEPA field review process, plan-in-hand review, design review, progress review during construction, and the road construction review process. See Forest Plan Monitoring Guide.

PR-23. Obliteration of Temporary Roads, Non-System Roads, and Landings

Objective: To reduce sediment and restore site productivity at the completion of the project.

Explanation: Temporary roads are constructed for a specific short-term purpose. In order to prevent continued resource impacts, such roads and landings are often obliterated at the completion of their intended use. Due to the location, grades, and drainage, such roads are often inadequate for long-term use and maintenance. Temporary roads that are allowed to remain in use beyond their prescribed time are subject to continued, uncorrected resource damage, and can become chronic sediment sources.

Effective obliteration is generally achieved through a combination of these measures:

- a. Temporary culverts and bridges removed and natural drainage configuration re-established.
- b. Road surface ripped below the level of compaction.
- c. Sideslopes reshaped and stabilized.
- d. Road effectively drained and blocked.
- e. Road returned to resource production through revegetation (grass, brush, or trees).
- f. Effective closure at the entrance of the road.

The National Forest Management Act requires that all temporary roads be returned to resource production within ten years.

Implementation and Responsibility: Scarification and revegetation are required by contract provisions. The sale administrator ensures that, at the time of sale closure, temporary roads are closed by the purchaser and erosion controls on open roads are adequate to achieve the objectives of this BMP.

Ability to Implement: High

Effectiveness: High

Monitoring: The sale administrator will document implementation of closures and erosion control in the Timber Sale Inspection Report. Post-harvest reviews.

FIRE SUPPRESSION AND FUELS MANAGEMENT BMPS

PF-1. Fire and Fuel Management Activities

Objective: Reduce the potential public and private losses which could result from wildfire and/or subsequent flooding and erosion, by reducing the frequency, intensity and destructiveness of wildfire.

Explanation: Timber harvest and National Fire Plan activities can create additional fuel residues (slash). The harvest units are analyzed and evaluated for potential wildfire hazard and associated damage to water quality. If necessary, slash will be treated to reduce the risk of catastrophic fire and subsequent flooding and erosion. Potential fuel treatments will be evaluated on a unit-by-unit basis. Treatment prescriptions will provide for retention of the kind and amount of residues needed for on-site benefit of water resources in the Project Planning Area. Units displaying a minimal resource risk due to wildfire will not be treated for hazard reduction but may be treated for site preparation. The following fire hazard reduction measures will be considered:

- a. Broadcast burning
- b. Underburning and jackpot burning
- c. Lopping and scattering of slash
- d. Grapple piling
- e. Leaving tops attached (LTA) during yarding operations, to reduce post-harvest fuel loading

Implementation and Responsibility: Fuel Management is implemented through normal program planning and budgeting and NEPA processes, predominantly by the Forest Service fire management

organization. Other resource specialists may be involved in fuel modification projects that are implemented by Fire Management. The management constraints and multiple resource protection prescriptions are documented in the Brush Disposal appraisal and the individual unit burn plans. The Fuels Management Specialist will evaluate the need for interdisciplinary team assistance in developing burn plans.

Ability to Implement: High

Effectiveness: High

Monitoring: Implementation and effectiveness monitoring is done by fuel management and other specialists within the Forest Service fire organization. Watershed specialists evaluate the effectiveness of the soil and water mitigation measures for selected projects. See Forest Plan Monitoring Guide, Item 25B: Watershed Best Management Practices and Item 26: Riparian Areas.

PF-2. Consideration of Water Quality in Formulating Prescribed Fire Prescriptions

Objective: To provide for water quality protection while achieving management objectives through the use of prescribed fire.

Explanation: Fire prescription elements will be developed with specific concerns for the protection of water, soils, and riparian vegetation. Prescription elements include, but are not limited to, fire weather, aspect, vegetation moisture, and fuel moisture. Consideration of these elements will provide the greatest success in protecting riparian vegetation, maintaining soil productivity, and minimizing soil repellency and erosion. Prescription elements will be designed to control fire intensity, rate of spread, residence time, and fuel consumption. Some measures to achieve these objectives will be:

- a. Seasonal and weather constraints on burning when soil, duff, and fuel moistures are high enough to reduce consumption (i.e. spring burning). Effective ground cover will generally range from about 40% on flat slopes up to about 70% on steep slopes. Prescribed fire should be light enough to avoid creation of burned soils (significantly changed color, oxidized to a reddish color) and hydrophobic soil conditions.
- b. Exclude prescribe fire from RHCA's areas by constructed firelines or use of natural barriers. Prescribed fire boundaries will use RHCA boundaries to determine the limits of ignition. Backing fires will be allowed to enter RHCA's. Avoid building firelines along RHCA boundaries where possible.

Implementation and Responsibility: The Fuels AFMO will develop burn plans based on all resource requirements. The burn plans will be approved by the appropriate line officer.

Ability to Implement: High

Effectiveness: High

Monitoring: Post-sale reviews.

PF-3. Protection of Water Quality During Prescribed Fire Operations

Objective: To maintain soil productivity, minimize erosion, and prevent ash, sediment, nutrients, and debris from entering water bodies.

Explanation: To prevent water quality degradation prescribed burn plan prescription elements would produce a short duration, low to moderate intensity fire. The prescription would be developed to maintain the integrity of streamcourses and riparian vegetation by encouraging re-establishment of ground vegetation, minimizing consumption of duff and construction of firelines, and burning under conditions that minimize hydrophobic soil conditions. Lighting methods and patterns would be used that avoid or minimize burning in stream and riparian zones and identified sensitive soils. Some of the techniques used to prevent water quality degradation in the project will be:

- a. Constructing water bars in fire lines.

- b. Maintaining the integrity of Riparian Habitat Conservation Areas and wetlands. Machine constructed firelines will not be used in or adjacent to RHCA's. Use wetlines as feasible, to avoid the use of handlines.
- c. If pumps are used they will have a spill containment system including a barrier and absorbent pads. Pumps will be placed so they will not alter the streambed or provide a barrier to fish passage.

Implementation and Responsibility: The District FMO is responsible for implementing the prescribed burn.

Ability to Implement: High

Effectiveness: High

Monitoring: The FMO and appropriate resource specialists will review the implementation and effectiveness of this BMP during post burn reviews.